

Nova Scotia on the afternoon of the 29th, with a minimum pressure of 29.10. After reaching the Mississippi Valley general precipitation set in over the Mississippi and Missouri valleys and all the country to the eastward. Although the barometer gradient was at times quite steep, dangerous winds were only reported along the Atlantic coast north of Cape Hatteras. The temperature fell to the freezing point in all districts, except along the coast of the Gulf of Mexico, seriously injuring the early vegetable crops in the Southern States.

XI.—It was noticed on the afternoon map of the 28th that the temperature had risen 16°, and the pressure had decreased

.28 in twenty-four hours in northern Montana. The evening map of the same date permitted an isobar of 29.80 to be drawn, and other conditions appeared favorable to the presence of a moderate cyclone. The low area at once began to move in a southerly direction, arriving in northern Texas in twenty-four hours, with a central isobar of 29.50. A high area was then central in the Ohio Valley, with highest pressure 30.25. The low area changed its direction to an easterly course and passed off the coast of North Carolina on the evening of the 31st. Light rains prevailed over the Gulf States during its progress, with occasional thunder-storms.

NORTH ATLANTIC STORMS DURING MARCH, 1887.

[Pressure in inches and millimetres; wind-force by Beaufort scale.]

The paths of the depressions that have appeared over the north Atlantic Ocean during the month are determined, approximately, from international simultaneous observations furnished by captains of ocean steamships and sailing vessels; abstracts of ships' logs and other data collected by the Signal Service agencies at the ports of New York, Boston, and Philadelphia; reports received through the co-operation of the "New York Herald Weather Service;" abstracts of ships' logs furnished by the proprietors of the "New York Maritime Register," and from other miscellaneous data received at this office up to April 21, 1887.

Eleven depressions are traced, the tracks largely predominating to the southeastward and southward of Newfoundland and Nova Scotia, where their rate of progression was, in general, very slow, and the course of direction greatly diversified. During the first two decades of the month the more important storms which appeared were confined to the western half of the ocean, where deep barometric depressions, accompanied by storms of great violence, followed one another in rapid succession. During this period the barometric pressure over the eastern portion of the ocean remained almost continuously high, with generally settled weather within the region of observation east of the twenty-fifth meridian. During the last decade of the month cyclonic areas traversed the ocean from coast to coast, and the region of greatest storm frequency was included within an area extending from the east of the Banks of Newfoundland to the west coasts of the British Isles.

For March, 1886, ten depressions were traced, the tracks being rather evenly distributed over the ocean, with a general direction of movement from east to northeast. The depressions, as a rule, exhibited great depth and energy, and severe gales and generally unsettled weather prevailed throughout the month.

As compared with the corresponding month of previous years, the weather over the north Atlantic during March, 1887, was unusually severe west of the thirty-fifth meridian, this fact being due rather to the frequency of storms than to their exceptional individual strength.

The following are brief descriptions of the depressions:

1.—The presence of this storm to the southeast of Newfoundland was indicated by reports of the 1st, on which date it was central in about N. 45°, W. 48°, with barometric pressure about 29.50 (749.3). By the 2d the centre of depression had moved southeast to N. 41°, W. 43°, with a marked rise in central pressure, after which it apparently dissipated.

2.—This storm appeared on the 2d to the westward of the position occupied by depression number 1 on that date, having apparently developed to the southward of Newfoundland; passing slowly north of east, the storm-centre is traced to N. 42°, W. 46° by the 3d, and to N. 44°, W. 40° by the 4th, after which it disappeared. This depression, though shallow throughout its course, was accompanied on the 2d by severe storms, relative to which Capt. T. H. Fox, of the s. s. "Istrian," reports: "2d, in N. 41° 56', W. 51° 0' (at noon), wind veered to east and rapidly increased to a whole gale,

with thick fog and very heavy snow; found it necessary to put the ship's head to the sea and lessen speed; gale continued until noon of the 3d, in N. 41° 59', W. 48° 53'."

3.—This storm first appeared to the eastward of Newfoundland on the 6th, with central pressure about 29.10 (739.1); during the next four days the depression, shifting its position but slightly, occupied the ocean southeast of the Banks of Newfoundland, with barometric pressure ranging but slightly above 29.00 (736.6). During the 11th and 12th the centre of disturbance circled eastward, and apparently filled up to the northward of the Azores after the latter date. This depression was attended by disturbances of pronounced strength, as is shown by the following special reports:

Capt. A. G. Griffin, of the s. s. "Nederland," reports a whole gale from the 5th to the 7th; wind veered from s. to nw.; lowest barometer, 29.62 (752.3), at midnight of the 5th, in N. 43° 40', W. 41° 10'. Capt. T. M. Irwin, of the s. s. "Lepanto," reports a whole northerly gale on the 5th and 6th; lowest barometer, 29.52 (749.8), at 4 p. m. of the 5th, in N. 42° 20', W. 47° 40'. Capt. W. R. Lord, of the s. s. "Critic," reports an easterly hurricane on the 6th; lowest barometer, 29.23 (742.4), at noon, in N. 47° 5', W. 43° 41'. Capt. H. Parsell, of the s. s. "Adriatic," reports a strong to whole gale on the 7th and 8th; wind backed from se. to ne. and n.; lowest barometer, 29.00 (736.6), at 5 p. m. of the 7th, in N. 45° 47', W. 43° 7'. During the gale the sea was very confused, being characterized chiefly by a long heavy swell from n. and nnw., meeting a heavy sea from sse., continuing, after the backing of the wind, until midnight, then subsiding quickly. The north swell had no apparent local cause, and it appeared as though the locality steered over had been recently disturbed. Capt. G. Bakker, of the s. s. "W. A. Scholten," reports a storm of hurricane force from n. to nnw.; lowest barometer, 29.34 (745.2), at 12 noon of the 7th, in N. 42° 12', W. 46° 42'. Oil was used with good effect to keep the heavy waves clear of the ship. Capt. A. Redford, of the s. s. "City of Richmond," reports a whole n. to nnw. gale on the 7th and 8th; lowest barometer, 29.32 (744.7), at 2 a. m. of the 7th, in N. 40° 0', W. 51° 50'. The s. s. "Critic," having passed through the centre of a cyclone, encountered a very high sea, and laid to thirty-six hours, in N. 48° 49', W. 40° 9'. The s. s. "Bedford," Capt. T. Aitkenhead, commanding, in N. 39° 50', W. 43° 24' (at noon), had a fierce w. by n. gale, with terrific squalls; at 6 p. m. the wind shifted to n. in a heavy gale, with squalls of hurricane force and dangerous seas, which condition continued until midnight without abatement.

Capt. W. C. Bacon, of the s. s. "Coventry," reports: "8th, in N. 32° 27', W. 26° 11' (at noon); heavy squalls from the westward and much rain; barometer fell to 29.45 (748.0), and afterwards rose to 29.55 (750.6), but fell again to 29.25 (742.9) in the evening, with the wind backing to sw. and blowing force 8, with occasional showers." Capt. G. W. Murray, of the s. s. "Sapphire," reports: "9th, in N. 32° 58', W. 44° 28' (at noon); 6 hours, tremendous squalls of wind and rain, wsw. gale, incessant, barometer falling rapidly; 13 hours, wind hauled to nw., with rising barometer and terrific breaking seas

from wnw.; after the wind hauled the gale commenced to moderate and the sea to go down." Second Officer Potts, of the s. s. "British Crown," Capt. A. Smith, commanding, reports a fresh easterly gale on the 11th; lowest barometer, 29.39 (746.5), at noon of the 11th, in N. 48° 19', W. 35° 10'. Capt. G. Meier, of the s. s. "Elbe," reports a whole easterly gale on the 12th and 13th; lowest barometer, 29.47 (748.5), at 4 a. m. of the 12th, in N. 48° 13', W. 25° 29'.

4.—The presence of this storm to the southward of Nova Scotia was shown by reports of the 7th, and, while strong gales prevailed within its area during that date, the depression was shallow and evidently moved eastward and united with depression number 3 by the 8th.

5.—This depression was a continuation of low area number iv which is traced across the North American continent. Passing southward over Long Island during the early morning of the 10th, the storm circled eastward to N. 39°, W. 58° by the 13th; thence passing eastward of north and disappearing beyond the northern limit of the region of observation after the 14th. This depression had pressure ranging below 29.00 (736.6), and was accompanied by gales, attaining hurricane force. The following special reports refer to disturbances encountered within its area:

Capt. L. W. Hoff, of the s. s. "R. F. Matthews," reports: "10th, while running before an ese. gale the wind suddenly increased to hurricane force and veered to sw. and w., with increasing strength; when the wind shifted the sky cleared for about two hours; lowest barometer, 28.62 (726.9), at 10.20 p. m. of the 19th, in N. 40° 12', W. 65° 45'. Capt. H. Parsell, of the s. s. "Adriatic," reports a whole gale on the 10th and 11th; wind backed from ese. to nw.; lowest barometer, 29.27 (743.4), at 7 p. m. of the 10th, in N. 40° 52', W. 67° 15'. Capt. D. T. Pedersen, of the bark "Matthanja," reports: "10th, in N. 36° 48', W. 65° 49' (at noon); hard gale commenced, and by 4 p. m. it was blowing a heavy storm from se. The sea was heavy and from the same direction, and heavy rain fell; 12 midnight, storm went to sw. 11th, 4 a. m., storm veered to w.; ship running ese. against a heavy sea. During the 12th the storm attained a fearful force, and continued until midnight of the 13th, in N. 35°, W. 53°." The s. s. "Gwendoline," Capt. Robert Milburn, commanding, on the 10th, in N. 38° 50', W. 71° 30' (at noon), passed through the centre of the cyclone at 3 p. m., and encountered very heavy weather during the next two days.

Capt. M. Fitt, of the s. s. "Virginian," reports a whole gale on the 11th; wind backed from ene. to nnw.; lowest barometer, 29.24 (742.7), at 7.52 a. m., in N. 42° 33', W. 64° 54'. The gale was accompanied by heavy snow and high seas throughout, and sleet at intervals. Capt. D. Williams, of the s. s. "Roman," reports a whole gale on the 11th; wind backed from e. to n.; lowest barometer, 29.30 (744.2), at noon, in N. 42° 7', W. 65° 47'. The gale was attended by violent squalls, terrific seas, and heavy snow. Capt. A. G. Griffin, of the s. s. "Nederland," reports a whole gale on the 11th and 12th; wind veered from e. to se. and backed to ene., n., and nw.; lowest barometer, 28.99 (736.6), on the evening of the 11th, in N. 40° 30', W. 66° 40'. Capt. W. McMickan, of the s. s. "Umbria," reports a strong gale on the 11th and 12th; wind veered from se. to nw.; lowest barometer, 28.83 (732.3), at 4 a. m. of the 12th, in N. 41° 0', W. 62° 30'. Capt. F. Archer, of the s. s. "Tower Hill," reports: "13th, 19 hours 12 minutes, in N. 43° 49', W. 47° 50', lowest barometer, 29.06 (738.1), with heavy sw. swell, followed by moderate sw. to w. winds."

6.—This storm was a continuation of low area number v which first appeared over the North American continent and passed eastward off the coast in about N. 36° during the early morning of the 14th; thence moving slowly northward, the depression disappeared over mid-ocean after the 18th. The disturbances accompanying this very deep depression were exceptionally severe in their character, as is shown by the following special reports of shipmasters:

Capt. H. Supmer, of the s. s. "Donau," reports a gale on

the 14th and 15th; wind backed from nne. to nw.; lowest barometer, 29.00 (736.6), at 4 a. m. of the 15th, in N. 39° 18', W. 67° 11'. Capt. S. Nowell, of the s. s. "British Prince," reports a gale on the 14th and 15th; wind backed from ne. to nw.; lowest barometer, 29.29 (744.0), from 2 to 4 a. m. of the 15th, in N. 39° 29', W. 68° 25'. The s. s. "British Crown" had an ene. gale on the 16th; lowest barometer, 28.70 (729.0), at 2 a. m., when fifteen miles south of Sable Island. Capt. W. Tyson, of the s. s. "Holland," reports a strong gale from the 15th to 17th; wind veered from se. to nw.; lowest barometer, 28.56 (725.4), at 4 a. m. of the 16th, in N. 41° 40', W. 59° 0'. Capt. W. Kuhlewein, of the s. s. "Gellert," reports a strong sw. to nw. gale during the 16th and 17th; lowest barometer, 28.96 (735.6), at 11 a. m. of the 16th, in N. 41° 30', W. 55° 10'. Capt. J. Brown, of the s. s. "Alsatia," reports a strong westerly gale on the 16th; lowest barometer, 28.58 (725.9), at 3 a. m., in N. 40° 20', W. 59° 50'.

Mr. J. W. Mitchell, observer on the s. s. "Queen," Capt. J. Milligan, commanding, reports: "17th, in N. 44° 10', W. 45° 20', at 4.12 p. m. the weather was threatening, with every appearance of an approaching storm, the barometer fell rapidly, with sw. wind, rain, high sea, and frequent lightning; from 8 p. m. to midnight the barometer fell from 29.22 (742.2) to 28.64 (727.4); the wind during that time was blowing with hurricane force, with very heavy rain; at 1 a. m. of the 18th the wind shifted in a remarkable squall to nw. and blew steadily for three hours, when it gradually moderated, the barometer rising between 1 and 3.30 p. m. from 28.64 (727.4) to 29.40 (746.7), and after this rising in an ordinary manner; position at noon of the 18th, N. 42° 50', W. 50° 3'." Capt. G. Franck, of the s. s. "Australia," reports a n. to w. storm on the 17th; lowest barometer, 28.76 (730.5), at noon, in N. 41° 1', W. 54° 26'. Capt. E. Franguel, of the s. s. "La Bourgogne," reports a gale attaining hurricane force on the 17th; wind veered from s. to wnw.; lowest barometer, 28.67 (728.2), at 3 p. m., in N. 42° 0', W. 53° 0'. Third Officer C. A. Ledder, of the s. s. "Waesland," Capt. J. Ueberweg, commanding, reports: "18th, in N. 44° 43', W. 38° 22', at 3 p. m., barometer 29.30 (744.2), fresh gale commenced, lasting six hours, attended by very heavy squalls and rain; a tremendous sea continued until midnight, when wind and sea moderated; wind during gale from w. and wnw."

7.—This storm apparently advanced from the southwestward to N. 40°, W. 56° on the 18th, whence it moved northeast and disappeared to the northward of the Banks of Newfoundland, in which region its centre cannot be located, owing to an absence of reports. In the position above cited the depression had central pressure ranging below 29.00 (736.6), and was attended by hard gales and rain, which prevailed over a considerable area.

The following special reports have been rendered relative to this depression:

Capt. W. A. Freethy, of the s. s. "Jeanie," reports a whole westerly gale on the 17th and 18th; lowest barometer, 29.30 (744.2), in N. 32° 50', W. 70° 11'. Capt. T. Burley, of the s. s. "Clement," reports a fresh gale from the 17th to the 20th; wind veered from sw. by s. to nw. by n.; lowest barometer, 29.38 (746.2), at 2.30 p. m. of 17th, in N. 32° 5', W. 68° 45'. Capt. R. Milburn, of the s. s. "Gwendolin," reports a hurricane on the 17th; wind veered from sse. to nw.; lowest barometer at noon, in N. 39° 42', W. 53° 10'. Capt. W. Gleig, of the s. s. "Kansas," reports a fresh gale on the 19th; wind veered from sse. to wnw.; lowest barometer, 29.01, (736.8), at midnight, in N. 42° 40', W. 45° 20'.

8.—This storm was central on the 20th in N. 48°, W. 39°, with central pressure about 28.80 (731.5), and, while it was probably a continuation of number 7, an absence of reports from the intervening territory will not justify the uniting of their tracks on the chart. By the 21st the centre of depression had passed rapidly east-northeast to N. 52°, W. 18°, with slight changes in central pressure, thence passing northeast beyond the region of observation. This was the first depression for the month that is traced eastward of the thirtieth

meridian; in advance of its passage the area of high barometer which occupied the eastern half of the ocean gave way, and for the balance of the month the storms are, as a rule, traced to the vicinity of the British Isles.

The following reports show the general character of the disturbances encountered during the passage of this depression:

Captain Barends, of the s. s. "Lessing," reports: "20th, in N. 46° 10', W. 38° 50', at noon; at 12.30 p. m. the wind veered from wsw. to nw., and increased very rapidly to force 11, the barometer being down to 28.69 (728.7), and afterwards rising rapidly, with wind decreasing slowly to fresh gale by 6.30 p. m., and changing from nw. to nnw. and back again." Third Officer W. H. Logan, of the s. s. "Istrian," Capt. T. H. Fox, commanding, reports: "19th, strong gale from sse., with very high and confused sea. 20th, in N. 51° 38', W. 26° 49', at noon; at 6 a. m. the wind moderated, but the sea was getting more confused and the ship rolled and labored heavily; at 4 p. m. the wind had fallen to a fresh breeze, but a tremendous sea was running from all quarters; at 10 p. m. the wind shifted suddenly to westward and blew with hurricane force for about two hours, after which it settled into a heavy gale with mountainous seas until 6 a. m. of the 21st; lowest barometer, 28.68 (728.5), at midnight of the 20th, in N. 50° 16', W. 28° 37'."

Capt. A. W. Lewis, of the s. s. "City of Chester," reports a whole gale, westerly, on the 20th; lowest barometer, 28.86 (733.0), at 10 a. m., in N. 45° 30', W. 37° 40'. Capt. G. Cochran, of the s. s. "Helvetia," reports a whole s. to nnw. gale on the 20th; lowest barometer, 28.61 (726.7), at 10.10 a. m., in N. 45° 30', W. 38° 0'. Capt. H. Richter, of the s. s. "Saale," reports a whole sw. to nw. gale on the 20th and 21st; lowest barometer, 28.57 (725.7), at 5 p. m. of the 20th, in N. 47° 36', W. 29° 45'. Capt. P. J. Irving, of the s. s. "Republic," reports a fresh gale on the 19th and 20th; wind veered from se. to nw.; lowest barometer, 28.83 (732.3), at noon of the 20th, in N. 48° 8', W. 33° 59'. Capt. W. Janes, of the s. s. "Warwick," reports a storm on the 19th and 20th; wind veered from sse. to s.; lowest barometer, 28.70 (729.0), at 2.30 a. m. of the 20th, in N. 44° 56', W. 44° 25'.

Capt. J. Wilson, of the s. s. "Ethiopia," reports a whole gale from the 19th to the 22d; wind veered from sse. to sw.; lowest barometer, 28.36 (720.3), at midnight of the 20th-21st, in N. 53° 30', W. 22° 30'. Capt. J. Schade, of the s. s. "Polaria," reports a whole gale on the 21st and 22d; wind veered from ssw. to nw.; lowest barometer, 28.95 (735.3), at 2 p. m. of the 21st, in N. 50° 21', W. 15° 20'. Capt. M. de Jouselin, of the s. s. "La Bretagne," reports a storm on the 21st; wind veered from se. to wnw.; lowest barometer, 28.79 (731.3), at 6 a. m., in N. 49° 25', W. 19° 0'. Captain Schultdt, of the s. s. "Grasbrook," reports a whole gale on the 20th and 21st; wind veered from s. to nw.; lowest barometer, 28.72 (729.5), at 5 a. m. of the 21st, in N. 49° 55', W. 21° 26'. Capt. W. Skjodt, of the s. s. "Island," reports a westerly storm on the 22d and 23d; lowest barometer, 29.40 (746.7), at midnight of the 22d, in N. 59° 30', W. 1° 40'.

9.—This depression first appeared in N. 42°, W. 55° on the 20th, with central pressure about 29.40 (746.7), whence it had apparently advanced from the westward; from this position the storm-centre moved east to the forty-eighth meridian by the 21st, where minimum pressure about 29.20 (741.7) was shown; thence passing rapidly north of east the depression is charted under date of the 22d in N. 46°, W. 29°, with slight changes in barometric pressure; by the 23d the storm-centre had moved rapidly northeast to about N. 58°, W. 15°, without an appreciable loss of energy, after which it disappeared beyond the region of observation.

The following special reports refer to this storm:

Capt. J. B. Watt, of the s. s. "Samaria," reports a strong e. to nne. gale on the 21st and 22d; lowest barometer, 29.04 (737.6), at midnight of the 21st, in N. 44° 30', W. 43° 50'. Capt. T. Jungst, of the s. s. "Ems," reports a sw. to nw. storm or hurricane on the 20th and 21st; lowest barometer, 28.77 (730.7), at 4 a. m. of the 21st, in N. 44° 34', W. 43° 10'. Capt.

S. T. H. Laub, of the s. s. "Thingvalla," reports a hurricane on the 22d and 23d; wind veered from sse. to nuw.; lowest barometer, 28.79 (731.3), from 1 to 2 a. m. of the 23d, in N. 56° 40', W. 18° 10'. Capt. J. Bentley, of the s. s. "Austrian," reports a whole westerly gale on the 24th; lowest barometer, 29.13 (739.9), at noon, in N. 55° 33', W. 7° 48'.

10.—This storm was a continuation of land depression number vi which passed northeastward along the coast and over the Maritime Provinces during the 22d and 23d, accompanied by severe gales over the ocean to the southward of Newfoundland and Nova Scotia. During the early morning of the 24th the depression passed eastward from the northern extremity of Newfoundland, whence it is given a probable east-northeast track to the northwestward of the British Isles by the 26th. This storm, while evidently possessing considerable depth, passed too far to the northward to be seriously felt over, and to the southward of, the trans-Atlantic tracks.

11.—This storm appeared over mid-ocean, in N. 50°, on the 28th, thence moving slowly east-southeast to N. 48° W. 23° by the 29th, after which it filled up. The depression was slight and its passage was unattended by noteworthy features.

During the last five days of the month severe disturbances were encountered off the eastern coast of the United States and over the Gulf of Mexico, attending the passage over the United States of low areas numbers x and xi. From special reports received relative to these disturbances, it would appear, that in instances, they were due to the development of subsidiary depressions in the second or southeast quadrant of the principal low areas referred to.

OCEAN ICE.

On chart i are also exhibited the limits within which icebergs and field ice were reported during March, 1887. These limits are determined from reports furnished by shipmasters, and from data collected by the Signal Service agencies.

During this month the easternmost icebergs reported were passed on the 4th, in N. 45° 31', W. 42° 56', by the s. s. "Shakspeare." From this position an area in which no ice was reported during the month extended westward over the Banks of Newfoundland. Between the forty-first and forty-fifth parallels, and from W. 46° to W. 51°, ice was observed in large quantities throughout the month. From the 20th to the 24th icebergs and extensive ice-fields were encountered along the coast of Newfoundland in the vicinity of Saint John's and Cape Race, and on the 20th a field of ice passed to the southward of Sable Island. Advices from Ottawa; under date of the 22d, stated that the Gulf of Saint Lawrence was filled with closely packed ice, except off Cape Rozier. Mr. J. Higgins, observer at Saint John's, Newfoundland, reports that heavy ice jammed in on the land on the 11th, 15th, 16th, 19th, 20th, 21st, and 23d, driving off fast during the 24th.

Compared with the chart for the preceding month, February, 1887, the eastern and southern limits of the ice-region have contracted slightly, while the movement of ice along the east coast of Newfoundland has very largely increased.

Compared with the corresponding month of previous years, the southward movement of Arctic ice during March, 1887, was unusually large, and, as compared with the ice reported during March, 1886, the quantity was vastly in excess.

The following table shows the southern and eastern limits of the region within which ice was reported for March during the last six years:

Southern limit.			Eastern limit.		
Month.	Lat. N.	Lon. W.	Month.	Lat. N.	Lon. W.
March, 1882.....	42 30	50 00	March, 1882.....	46 30	46 00
March, 1883.....	41 46	49 48	March, 1883.....	48 40	43 03
March, 1884.....	41 20	54 06	March, 1884.....	45 00	40 15
March, 1885.....	40 55	49 04	March, 1885.....	45 57	43 15
March, 1886.....	40 20	49 02	March, 1886.....	47 20	44 40
March, 1887.....	41 00	49 07	March, 1887.....	45 31	42 56